CLAIM + DETAILED DESCRIPTION

[Claim(s)]

[Claim 1] The exhaust air purification catalyst which returns and purifies the nitrogen oxide which is arranged in the exhaust passage of an internal-combustion engine, and is contained during exhaust air, A reducing agent supply means to supply the reducing agent which reduction of said nitrogen oxide takes to said exhaust air purification catalyst, An exhaust air flowing-back means to flow back to the air intake passage of said internal-combustion engine in a part of exhaust air which flows through the exhaust passage of said exhaust air purification catalyst upper stream, An amount detection means of nitrogen oxide to detect the amount of nitrogen oxide which is arranged at least in the exhaust passage of said exhaust air purification catalyst lower stream, and is contained during exhaust air, When the actual amount of nitrogen oxide detected by said amount detection means of nitrogen oxide has separated from the predetermined target range The exhaust emission control device of the internal-combustion engine characterized by having an exhaust air purification control means to control said exhaust air flowing-back means and said reducing agent supply means that priority should be given to flowing back of exhaust air as compared with supply of a reducing agent.

[Claim 2] [said exhaust air purification control means] when the actual amount of nitrogen oxide has exceeded said target range When said exhaust air flowing-back means and said reducing agent supply means are controlled that priority should be given to increase in quantity of the amount of exhaust air flowing back as compared with increase in quantity of the amount of supply of a reducing agent and the actual amount of nitrogen oxide is less than said target range The exhaust emission control device of the internal-combustion engine according to claim 1 characterized by controlling said exhaust air flowing-back means and said reducing agent supply means that priority should be given to loss in quantity of the amount of supply of a reducing agent as compared with loss in quantity of the amount of exhaust air flowing back.

[Claim 3] When hyperoxia and hydrocarbon exist, said exhaust air purification catalyst is the

nitrogen oxide under exhaust air a selection reduction type NOX catalyst returned or decomposed, and [said reducing agent supply means] The exhaust emission control device of the internal-combustion engine according to claim 1 characterized by supplying said selection reduction type NOX catalyst by using fuel for said internal-combustion engine as a reducing agent.

[Claim 4] If a difference with the upper limit of the actual amount of nitrogen oxide when the amount of control of said exhaust air flowing-back means by said exhaust air purification control means and said reducing agent supply means becomes the maximum or the minimum, and said target range, or a lower limit is more than the specified quantity The exhaust emission control device of the internal-combustion engine according to claim 1 which has further an unusual judging means to judge with abnormalities having occurred.

[Claim 5] An amount detection means of lower stream side nitrogen oxide to detect the amount of nitrogen oxide contained in the exhaust air which has been arranged in the exhaust passage of said exhaust air purification catalyst lower stream, and flowed out of said exhaust air purification catalyst, It is arranged in the exhaust passage of said exhaust air purification catalyst upper stream, have a upper stream side nitrogen oxide detection means to detect the amount of nitrogen oxide contained in the exhaust air which flows into said exhaust air purification catalyst, and [said unusual judging means] Based on the amount of nitrogen oxide which said amount detection means of upper stream side nitrogen oxide detected, the abnormalities of said internal-combustion engine or said exhaust air flowing-back means are judged. The exhaust emission control device of the internal-combustion engine according to claim 4 characterized by judging the abnormalities of said reducing agent supply means or said exhaust air purification catalyst based on the amount of nitrogen oxide which said amount detection means of lower stream side nitrogen oxide detected.

[0000]

[Detailed Description of the Invention]

[Field of the Invention] This invention relates to the exhaust air purification technology which controls the amount of nitrogen oxide contained in the exhaust air discharged by the internal-combustion engine.

[0001]

[Description of the Prior Art] In the internal-combustion engine carried in a car etc., it is required that harmful gas ingredients contained during exhaust air, such as hydrocarbon (HC), carbon monoxide (CO), and nitrogen oxide (NOX), should be purified. The exhaust air purification system which prepares the three-way catalyst whose purification of HC, CO, and NOX which are contained while exhausting, when exhaust air of the air-fuel ratio of the request

near the theoretical air fuel ratio flows to such a demand is attained in the exhaust passage of an internal-combustion engine is proposed.

[0002] On the other hand although development of the lean combustion internal-combustion engine with which fuel concentration can be low and with which it can burn the fuel-air mixture of a hyperoxia state for the purpose of improvement in specific fuel consumption is furthered in the internal-combustion engine carried in a car When the exhaust air purification catalyst described above to such a lean combustion internal-combustion engine was applied, exhaust air of an air-fuel ratio higher than theoretical air fuel ratio will flow into a three-way catalyst, and there was a problem of it becoming impossible to fully purify NOX which a three-way catalyst is exhausting.

[0003] The method of controlling the generating of NOX in an internal-combustion engine itself as a method of controlling the amount of NOX(s) discharged in the atmosphere by the former and the method of purifying, before discharging in the atmosphere NOX generated with the internal-combustion engine are proposed to such a problem.

[0004] As a method of controlling generating of NOX, the EGR (Exhaust Gas Recirculation) equipment indicated to JP,H10-103161,A and JP,H10-252573,A is known, for example. [such EGR equipment] by supplying a part of exhaust air discharged by the internal-combustion engine to the burner of an internal-combustion engine The burning velocity and burning temperature in a burner tend to be reduced using the non-flammability and endothermy of inactive gas, such as carbon dioxide contained in exhaust air, and it is going to control the generating of NOX itself.

[0005] Moreover, the method of putting side by side an exhaust emission control device which was indicated to JP,H5-113116,A to an internal-combustion engine, for example as a method of purifying NOX generated with the internal-combustion engine, before being discharged in the atmosphere is known. The selection reduction type NOX catalyst which such an exhaust emission control device is arranged in an exhaust passage, and returns or decomposes NOX under existence of the atmosphere of hyperoxia and hydrocarbon, The reducing agent feed unit which supplies hydrocarbon as a reducing agent to this selection reduction type NOX catalyst, It is going to reduce the amount of NOX(s) emitted into the atmosphere by having an amount detection means of NOX(s) to detect the amount of NOX(s) contained in the exhaust air which flowed out of the selection reduction type NOX catalyst, and controlling the amount of supply of a reducing agent so that the actual amount of NOX(s) contained in exhaust air turns into the desired amount of target NOX(s).

[0006]

[Problem to be solved by the invention] By the way, with EGR equipment, when the amount of exhaust air flowing back is increased superfluously, a combustion state becomes unstable and there is a possibility of causing the increase in harmful gas ingredients, such as carbon

monoxide and hydrocarbon. On the other hand, with the exhaust emission control device equipped with the selection reduction type NOX catalyst and the reducing agent feed unit, when the poison ingredient represented by SOx etc. is contained in the reducing agent, poison of the selection reduction type NOX catalyst is carried out by supply of a reducing agent, and there is a possibility that the purification performance of a selection reduction type NOX catalyst may fall. In the exhaust emission control device equipped with the selection reduction type NOX catalyst and the reducing agent feed unit, when the fuel for an internal-combustion engine is used as a reducing agent, there is a possibility that the effect of a lean combustion internal-combustion engine may be offset by the increase in fuel consumption.

[0007] It aims at offering the technology in which the amount of NOX(s) emitted into the atmosphere can be reduced effectively, this invention being made in view of a problem which was described above, and preventing aggravation of organization operational status, degradation of an exhaust air purification catalyst, or aggravation of specific fuel consumption.

[0008]

[Means for solving problem] This invention is the exhaust emission control device of an internal-combustion engine, and is constituted as follows as said The means for solving a technical problem. Namely, the exhaust air purification catalyst which returns and purifies the nitrogen oxide which the exhaust emission control device of this invention is arranged in the exhaust passage of an internal-combustion engine, and is contained during exhaust air, A reducing agent supply means to supply the reducing agent which reduction of said nitrogen oxide takes to said exhaust air purification catalyst, An exhaust air flowing-back means to flow back to the air intake passage of said internal-combustion engine in a part of exhaust air which flows through the exhaust passage of said exhaust air purification catalyst upper stream, An amount detection means of nitrogen oxide to detect the amount of nitrogen oxide which is arranged at least in the exhaust passage of said exhaust air purification catalyst lower stream, and is contained during exhaust air, When the actual amount of nitrogen oxide detected by said amount detection means of nitrogen oxide has separated from the predetermined target range, it is characterized by having an exhaust air purification control means to control said exhaust air flowing-back means and said reducing agent supply means that priority should be given to flowing back of exhaust air as compared with supply of a reducing agent.

[0009] Thus, since an exhaust air purification catalyst and a reducing agent supply means, and an exhaust air flowing-back means are used together and reduction of the amount of NOX(s) is achieved in the constituted exhaust emission control device, While the reducing agent amount of supply decreases from the case where the amount of NOX(s) is reduced only with an exhaust air purification catalyst and a reducing agent supply means, the amount of exhaust air flowing back decreases from the case where the amount of NOX(s) is reduced only with an exhaust air flowing-back means.

[0010] If the amount of nitrogen oxide with an actual exhaust emission control device has exceeded the target range in that case If the exhaust air flowing-back means and the reducing agent supply means were controlled that priority should be given to increase in quantity of the amount of exhaust air flowing back as compared with increase in quantity of the amount of supply of a reducing agent and the actual amount of nitrogen oxide is less than the target range In order to control an exhaust air flowing-back means and a reducing agent supply means that priority should be given to loss in quantity of the amount of supply of a reducing agent as compared with loss in quantity of the amount of exhaust air flowing back (i.e., since flowing back of exhaust air is performed more preferentially than supply of a reducing agent), the poison of the exhaust air purification catalyst resulting from supply of the reducing agent is controlled.

[0011] As the above-mentioned exhaust air purification catalyst, when hyperoxia and hydrocarbon exist, the selection reduction type NOX catalyst which returns or disassembles the nitrogen oxide under exhaust air can be illustrated, for example. In this case, what contains reduction ingredients, such as hydrocarbon and carbon monoxide, like the fuel for internal-combustion engines as a reducing agent can be illustrated.

[0012] [the exhaust emission control device concerning this invention] if a difference with the upper limit of the actual amount of nitrogen oxide when the amount of control of the exhaust air flowing-back means by an exhaust air purification control means and a reducing agent supply means becomes the maximum or the minimum, and the target range, or a lower limit is more than the specified quantity You may make it have further an unusual judging means to judge with abnormalities having occurred.

[0013] An amount detection means of lower stream side nitrogen oxide to detect the amount of nitrogen oxide contained in the exhaust air which the exhaust emission control device concerning this invention has been arranged in the exhaust passage of the exhaust air purification catalyst lower stream, and flowed out of the exhaust air purification catalyst, A upper stream side nitrogen oxide detection means to detect the amount of nitrogen oxide contained in the exhaust air which is arranged in the exhaust passage of the exhaust air purification catalyst upper stream, and flows into an exhaust air purification catalyst, You may make it have further an unusual judging means to judge the abnormalities of an internal-combustion engine or an exhaust air flowing-back means based on the amount of nitrogen oxide which the amount detection means of upper stream side nitrogen oxide detected, and to judge the abnormalities of a reducing agent supply means or an exhaust air purification catalyst based on the amount of nitrogen oxide which the amount detection means of lower stream side nitrogen oxide detected. In this case, it becomes easy to pinpoint the abrupt increase part at the time of abnormalities occurring.

[0014] [that said exhaust air purification catalyst should just be a catalyst which controls

discharge of generated NOX] For example, in addition to nitrogen oxide (NOX), an oxidation-reduction reaction decomposes each for carbon monoxide (CO) and hydrocarbon (HC). A three-way catalyst advantageous to purifying, a selection reduction type NOX catalyst advantageous to returning and purifying NOX under exhaust air generated when the fuel-air mixture of hyperoxia atmosphere is burned, etc. can be illustrated.

[0015] [the case where the reducing agent fuel injection equipment which is arranged in the exhaust passage of an internal-combustion engine, and injects a reducing agent to the exhaust passage of the exhaust air purification catalyst upper stream as said reducing agent supply means, and the fuel for an internal-combustion engine are used for a reducing agent] The subinjection which increases the amount of hydrocarbon under exhaust air can be illustrated by injecting fuel to a fuel room at the time of the exhaust stroke of an internal-combustion engine. These may be used independently respectively and may be used combining plurality.

[0016] Said exhaust air flowing-back means is flowing back exhaust air containing inactive gas, such as carbon dioxide, to a burner, reduces the burning velocity and burning temperature of fuel-air mixture, and controls the yield of NOX. Said amount detection means of nitrogen oxide may detect the quantity of NOX, and may detect the concentration of NOX. Moreover, the quantity or concentration of NOX may not be detected directly, but generating of NOX and other substances in correlation may be detected.

[0017] [the quantity or concentration of NOX / a nitrogen oxide detection means to detect directly] for example, a solid electrolyte type NOX sensor and the NOX sensor which detects the quantity or concentration of NOX by using a substance with simple substance crystal Mr. structure as a NOX induction object -- or While infixing the heater for heating between the electric insulating plates of two sheets, the sensing device which equipped the lateral surface part of one of electric insulating plates with the electrode can be formed in one, and the NOX sensor which detects the NOX concentration under exhaust air by which contact adsorption is carried out to the surface of this sensing device can be illustrated.

[0018] moreover, as generating of NOX, and other substances in correlation Carbon dioxide, oxygen, etc. which are contained during exhaust air are known, and you may make it presume the amount of NOX(s) or concentration under exhaust air based on correlativity with NOX from the detection result of a detection means (CO2 sensor or O2 sensor) to detect these substances.

[0019]

[Mode for carrying out the invention] It explains based on the Drawings hereafter attached about the form of operation of the exhaust emission control device concerning this invention.

[0020] <Form 1 of operation> The 1st embodiment of the exhaust emission control device concerning this invention is explained based on Drawings. Drawing 1 is the figure showing the outline composition of the internal-combustion engine which applies the exhaust emission

control device concerning this invention. The internal-combustion engine 1 which shows drawing 1 is the lean combustion-type gasoline engine with which fuel concentration can be low and with which it can burn the fuel-air mixture of a hyperoxia state.

[0021] The air intake passage 2 and the exhaust passage 3 are connected to the internal-combustion engine 1. Said air intake passage 2 and said exhaust passage 3 can be flowed back to the air intake passage 2 in a part of exhaust air which is connected by the EGR (Exhaust Gas Recirculation) pipe 4, and flows through the exhaust passage 3.

[0022] EGR valve 5 which adjusts the flux of the exhaust air which flows through the inside of this EGR pipe 4 to said EGR pipe 4 is formed. The EGR valve actuator 9 which carries out the opening-and-closing drive of this EGR valve 5 is attached to said EGR valve 5. It connects through the electronic control unit (ECU:Electronic Control Unit) 10 and wiring for internal-combustion engine control, and said EGR valve actuator 9 carries out the opening-and-closing drive of EGR valve 5 according to the signal from ECU10. Said EGR pipe 4, EGR valve 5, and the EGR valve actuator 9 are equivalent to the exhaust air flowing-back means in this invention.

[0023] From the connection part of said exhaust passage 3 and said EGR pipe 4, [the exhaust passage 3 by the side of the lower stream] The selection reduction type NOX catalyst 6 for purifying NOX contained during exhaust air, the reducing agent feed unit 7 which supplies a reducing agent to this selection reduction type NOX catalyst 6 from the upper stream side, and the NOX sensor 8 which detects the amount of NOX(s) under exhaust air which passed the selection reduction type NOX catalyst 6 are arranged.

[0024] As a reducing agent, when NOX is returned and decomposed in the selection reduction type NOX catalyst 6, the substance (quality of an oxide) combined with oxygen of NOX can be used, for example, but with the form of this operation, the gasoline which is the fuel for the internal-combustion engine 1 shall be used as a reducing agent.

[0025] As a reduction feed unit 7, it is a lower stream side from the connection part of the exhaust passage 3 and the EGR pipe 4, and the fuel injection equipment which injects gasoline is used into the exhaust passage 3 located in the upper stream side from the selection reduction type NOX catalyst 6.

[0026] [the sensor] while the NOX sensor 8 infixes the heater for heating between the electric insulating plates of two sheets It is the sensor which detects the amount of NOX(s) based on the resistance of the semiconductor resistance which changes according to the amount of NOX(s) in which it is prepared and constituted, and the sensing device which equipped the external surface of the electric insulating plate of either of the electric insulating plates of two sheets with the electrode is contacted or adsorbed on the surface of a sensing device. The NOX sensor 8 is connected with ECU10 through wiring, and the output signal of this NOX sensor is inputted into ECU10.

[0027] Said reducing agent feed unit 7 is one embodiment of the reducing agent supply means concerning this invention, and also has a method of injecting fuel by an exhaust stroke by the injection-of-fuel valve of an engine cylinder otherwise, and giving the fuel as a reducing agent during exhaust air. Moreover, said NOX sensor 8 is one embodiment of the nitrogen oxide detection means concerning this invention.
[0028] On the other hand at the air intake passage 2, the throttle 11 which adjusts the flux of new mind of flowing through this air intake passage 2 to an upstream part is arranged from the connection part with the EGR pipe 4. The throttle position sensor 12 which outputs the electric signal corresponding to the valve travel of this throttle 11 is attached to said throttle 11.
[0029] Said throttle position sensor 12 is connected with ECU10 through wiring, and the output signal (accelerator valve travel signal) of this throttle position sensor 12 is inputted into ECU10.

[0030] The organization revolving speed sensor 13 which detects the revolving speed of the crankshaft which is not illustrated is attached to the internal-combustion engine 1. The timing rotor with which this organization revolving speed sensor 13 was attached to the end of said crankshaft, for example, It consists of electromagnetism pickups attached to the cylinder block so that this timing rotor may be attended, and a pulse signal is outputted whenever a crankshaft carries out predetermined angle (for example, 30 degrees) rotation. The organization revolving speed sensor 13 is connected with ECU10 through wiring, and the output signal of the organization revolving speed sensor 13 is inputted into ECU10.
[0031] The amount map of target NOX(s) in which a relation with the amount of target NOX(s) which can be emitted into the atmosphere is shown in the operational status of the internal-combustion engine 1, and each operational status ECU10, The EGR limit map in which the relation between the operational status of the internal-combustion engine 1 and the upper limit (upper limit when controlling the EGR valve actuator 9) of the amount of EGR is shown, Various control maps, such as a reducing agent limit map in which the relation between the operational status of the internal-combustion engine 1, the upper limit of the amount of reducing agents supplied to the selection reduction type NOX catalyst 6, and a lower limit (upper limit and a lower limit when controlling the reducing agent feed unit 7) is shown, are set up.
[0032] As a parameter which shows the operational status of the internal-combustion engine 1, two parameters of accelerator valve travel and organization revolving speed can be used. The amount of target NOX(s) is the value set up so that the amount of NOX(s) emitted into the atmosphere might be settled in a NOX effluent control value.
[0033] The amount of NOX(s) under exhaust air according [ECU10] to the NOX sensor 8, the organization revolving speed signal by the organization revolving speed sensor 13, And the accelerator valve travel signal by a throttle position sensor 12 etc. is inputted, and the EGR

valve actuator 9 and the reducing agent feed unit 7 are controlled based on these input signals and the various above mentioned control maps. Specifically, ECU10 control the EGR valve actuator 9 and the reducing agent feed unit 7 based on an exhaust air purification control routine as shown in drawing 2 .

[0034] In an exhaust air purification control routine, ECU10 first read the output signal value (accelerator valve travel) of a throttle position sensor 12, and the output signal value (organization revolving speed) of the organization revolving speed sensor 13 in Step 100.

[0035] At Step 101, ECU10 are accessed to the amount map of target NOX(s) by making into a parameter the accelerator valve travel and organization revolving speed which were read in said step 100, and they compute the amount of target NOX(s) according to the operational status of the internal-combustion engine 1 (Xt).

[0036] At Step 102, ECU10 are accessed to an EGR limit map by making into a parameter the accelerator valve travel and organization revolving speed which were read in said step 100, and they compute the upper limit (the amount upper limit of EGR) of the amount of EGR according to organization operational status.

[0037] At Step 103, ECU10 read the output signal value (the actual amount of NOX(s): Xl) of the NOX sensor 8, and they measure the amount of target NOX(s) (Xt) computed at said step 101, and the actual amount of NOX(s) (Xl). ECU10 have more actual amounts of NOX(s) (Xl) than the amount of target NOX(s) (Xt), and, specifically, they distinguish whether the difference is over a fixed quantity (for example, is it Xl>1.05Xt or not?).

[0038] When it judges with it being Xl>1.05Xt in said step 103, ECU10 progress to Step 106, and they compute the instruction value (the amount increase-in-quantity instruction value of EGR) over the EGR valve actuator 9 in order to carry out the specified quantity increase in quantity of the amount of EGR.

[0039] At Step 107, ECU10 distinguish whether it is below the amount upper limit of EGR by which the amount increase-in-quantity instruction value of EGR computed at said step 106 was computed at said step 102.

[0040] When it judges with said amount increase-in-quantity instruction value of EGR being said below EGR upper limit in said step 107, ECU10 progress to Step 108, transmit said amount increase-in-quantity instruction value of EGR to the EGR valve actuator 9, and perform increase in quantity of the amount of EGR.

[0041] After performing processing of said step 108, ECU10 repeat and perform processing after Step 100. If it judges with it being Xl>1.05Xt in Step 103 in that case and judges with the amount increase-in-quantity instruction value of EGR having exceeded the amount upper limit of EGR in Step 107 further, ECU10 will progress to Step 109.

[0042] At Step 109, ECU10 compute the instruction value (reducing agent amount-of-supply increase-in-quantity instruction value) over the reducing agent feed unit 7 so that they may

carry out the specified quantity increase in quantity of the amount of reducing agents which should be supplied to the selection reduction type NOX catalyst 6.

[0043] At Step 110, ECU10 are accessed to a reducing agent limit map by making into a parameter the accelerator valve travel and organization revolving speed which were read in said step 100, and they compute the upper limit (reducing agent amount-of-supply upper limit) of the reducing agent amount of supply according to organization operational status. ECU10 compare with said reducing agent amount-of-supply upper limit the reducing agent amount-of-supply increase-in-quantity instruction value computed at said step 109.

[0044] When it judges with said reducing agent amount-of-supply increase-in-quantity instruction value being said below reducing agent amount-of-supply upper limit in said step 110, ECU10 progress to Step 111, they transmit said reducing agent amount-of-supply increase-in-quantity instruction value to the reducing agent feed unit 7, and make the quantity of the amount of supply of a reducing agent increase. ECU10 which finished performing processing of said step 110 repeat and perform processing after Step 100.

[0045] On the other hand, when it judges with said reducing agent amount-of-supply increase-in-quantity instruction value having exceeded said reducing agent amount-of-supply upper limit in said step 110, ECU10 progress to Step 117.

[0046] At Step 117, ECU10 carry out calculation of the number of times (m) which was missing from Step 117 from Step 100, and reached continuously in the same processing course, and they distinguish whether the discrete value has exceeded 5 times.

[0047] When it judges with said discrete value having exceeded 5 times in said step 117, it judges with this exhaust emission control device of ECU10 being unusual in Steps 118 and 119, and the warning lamp formed in the passenger compartment is made to turn on. On the other hand, when it judges with said discrete value being 5 or less times in said step 117, ECU10 repeat and perform processing after Step 100.

[0048] Next, when it judges with it not being Xl>1.05Xt in said step 103 (i.e., when it judges with it being Xl<=1.05Xt), ECU10 progress to Step 104.

[0049] At Step 104, ECU10 have few actual amounts of NOX(s) (Xl) than the amount of target NOX(s) (Xt), and they distinguish whether the difference is over a fixed quantity (for example, is it Xl<0.1Xt or not?).

[0050] When it judges with it being Xl<0.1Xt in said step 104, ECU10 progress to Step 117, they carry out calculation of the number of times which was missing from Step 117 from Step 100, and reached continuously in the same processing course, and distinguish whether the calculation is over 5 times.

[0051] Judge with this exhaust emission control device of ECU10 being unusual in Steps 118 and 119, when it judges with said discrete value being over 5 times in said step 117, and a warning lamp is made to turn on. When it judges with said discrete value being 5 or less times

in said step 117, processing after Step 100 is repeated and performed.

[0052] When it judges with it not being Xl<0.1Xt in said step 104 (i.e., when it judges with it being Xl>=0.1Xt) ECU10 progress to Step 105, and there are few actual amounts of NOX(s) (Xl) than the amount of target NOX(s) (Xt), and they distinguish whether the difference is over a fixed quantity (for example, is it Xl<0.95Xt or not?).

[0053] When it judges with it being Xl<0.95Xt in said step 105, ECU10 progress to Step 112 and they compute the instruction value (reducing agent amount-of-supply loss-in-quantity instruction value) over the reducing agent feed unit 7 that specified quantity loss in quantity of the amount of reducing agents which should be supplied to the selection reduction type NOX catalyst 6 should be carried out.

[0054] At Step 113, ECU10 are accessed to a reducing agent limit map by making into a parameter the accelerator valve travel and organization revolving speed which were read in said step 100, and they compute the lower limit (reducing agent amount-of-supply lower limit) of the reducing agent amount of supply according to organization operational status. ECU10 compare with said reducing agent amount-of-supply lower limit the reducing agent amount-of-supply loss-in-quantity instruction value computed at said step 112.

[0055] When it judges with said reducing agent amount-of-supply loss-in-quantity instruction value being larger than a reducing agent amount-of-supply lower limit in said step 113, ECU10 progress to Step 114, transmit said reducing agent amount-of-supply loss-in-quantity instruction value to the reducing agent feed unit 7, and make the quantity of the amount of supply of a reducing agent decrease.

[0056] ECU10 which finished performing processing of said step 114 repeat and perform processing after Step 100. If it judges with it being Xl<0.95Xt in Step 105 in that case and judges with a reducing agent amount-of-supply loss-in-quantity instruction value being below a reducing agent amount-of-supply lower limit in Step 113 further, ECU10 will progress to Step 115.

[0057] At Step 115, ECU10 compute the instruction value (the amount loss-in-quantity instruction value of EGR) over the EGR valve actuator 9 so that they may carry out specified quantity loss in quantity of the amount of EGR.

[0058] ECU10 transmit the EGR loss-in-quantity instruction value computed at said step 115 to the EGR valve actuator 9, and they make the quantity of the amount of EGR decrease at Step 116. ECU10 which finished performing processing of said step 116 repeat and perform processing after Step 100.

[0059] In addition, after ECU10 perform processing of said step 119, they return to Step 100 immediately, continue an exhaust air purification control routine, and it may be made to perform them, and they may be made to perform an exhaust air purification control routine after definite-period-of-time progress. Moreover, after ECU10 perform Step 119, they do not

perform an exhaust air purification control routine, but may be made to perform only lighting of a WENINGU lamp.

[0060] The EGR mechanism which the exhaust air purification control means which starts this invention when ECU10 perform an exhaust air purification control routine is realized as stated above, and flows back in an air intake system in a part of exhaust air, and controls generating of NOX, It becomes possible to aim at control of the amount of NOX(s) which uses together the NOX purification mechanism which supplies a reducing agent to the selection reduction type NOX catalyst 6, and returns and purifies NOX, and is emitted into the atmosphere.

[0061] Therefore, while becoming possible to control generating of NOX in the small amount of EGR compared with the exhaust emission control device which has only an EGR mechanism according to the exhaust emission control device concerning the form of this operation It becomes possible to return NOX by the small reducing agent amount of supply compared with the exhaust emission control device which has only a NOX purification mechanism. As a result, it becomes possible to reduce the amount of NOX(s) emitted into the atmosphere, preventing the poison of the selection reduction type NOX catalyst 6 resulting from aggravation of the operational status of the internal-combustion engine 1 resulting from the increase in the amount of EGR, and the increase in the reducing agent amount of supply.

[0062] Moreover, although the fuel for the internal-combustion engine 1 (gasoline) is used in the exhaust emission control device concerning the form of this operation as a reducing agent supplied to the selection reduction type NOX catalyst 6 Since it is preferentially flowed back by exhaust air to supply of a reducing agent, it becomes possible to control the fuel quantity consumed as a reducing agent to the minimum, and aggravation of specific fuel consumption and the poison (what is called poison-ed [SOx]) of the selection reduction type NOX catalyst 6 by the sulfur ingredient contained in fuel are prevented.

[0063] Moreover, in order to restrict when the actual amount of NOX(s) separates from the exhaust emission control device of this embodiment sharply from the target range of desired and the state carries out predetermined renewal of period, and to judge the abnormalities of an exhaust emission control device, When the actual amount of NOX(s) increased or decreases temporarily by sudden change of organization load etc., there is no possibility of carrying out a misjudgment law.

[0064] With the form of this operation, since the warning lamp in a passenger compartment is turned on when the abnormalities of an exhaust emission control device are judged, it becomes possible to notify the abnormalities of an exhaust emission control device to the driver of vehicles. As a result, a driver becomes possible [performing prompt disposal] so that he may restore an exhaust emission control device.

[0065] <Form 2 of operation> The 2nd embodiment of the exhaust emission control device concerning this invention is described hereafter. Here, different composition from the form of

the 1st operation of the above-mentioned is explained, and explanation is omitted about the same composition.

[0066] Drawing 3 is the figure showing the outline composition of the exhaust emission control device of this embodiment. The exhaust emission control device concerning the form of this operation receives the form of the 1st operation of the above-mentioned. In addition to NOX8 (the lower stream side NOX sensor 8 is called hereafter) prepared in the downstream exhaust passage 3 from the selection reduction type NOX catalyst 6, it has the upper stream side NOX sensor 18 which was able to be formed in the upstream exhaust passage 3 from the selection reduction type NOX catalyst 6.

[0067] Said upper stream side NOX sensor 18 is connected with ECU10 through wiring, and the output signal (signal which shows the amount of NOX(s) contained in the exhaust air which flows into the selection reduction type NOX catalyst 6) of said upper stream side NOX sensor 18 is inputted into ECU10.

[0068] Corresponding to this, ECU10 control the EGR valve actuator 9 and the reducing agent feed unit 7 according to an exhaust air purification control routine as shown in drawing 4 . In addition, by the exhaust air purification control routine shown in drawing 4 , the same mark as the form of the 1st operation is attached about the same processing as the exhaust air purification control routine of the form of the 1st operation of the above-mentioned. moreover, [the exhaust air purification control routine shown in drawing 4] The amount of target NOX(s) by the side of the upper stream of the selection reduction type NOX catalyst 6 (the amount of upper stream side target NOX(s)) Xtu, The actual amount of NOX(s) (the amount of lower stream side fruit NOX(s)) detected by Xu and the lower stream side NOX sensor 8 in the actual amount of NOX(s) (the amount of upper stream side fruit NOX(s)) detected by Xtl and the upper stream side NOX sensor 18 in the amount of target NOX(s) by the side of the lower stream (the amount of lower stream side target NOX(s)) shall be expressed as Xl.

[0069] By the exhaust air purification control routine shown in drawing 4 , ECU10 first read the output signal value (accelerator valve travel) of the throttle sensor 12, and the output signal (organization revolving speed) of the organization revolving speed sensor 13 in Step 100.

[0070] At Step 201, ECU10 are accessed to the amount map of target NOX(s) by making into a parameter the accelerator valve travel and organization revolving speed which were read in said step 100, and they compute the amount (Xtu) of upper stream side target NOX(s), and the amount (Xtl) of lower stream side target NOX(s).

[0071] At Step 102, ECU10 are accessed to an EGR limit map by making into a parameter the accelerator valve travel and organization revolving speed which were read in said step 100, and they compute the amount upper limit of EGR according to organization operational status.

[0072] At Step 203, ECU10 read the output signal value (the amount of upper-stream side fruit NOX(s): Xu) of the upper stream side NOX sensor 18, and they measure the amount of upper

stream side fruit NOX(s) (Xu), and the amount (Xtu) of upper stream side target NOX(s) computed at said step 201.

[0073] In said step 203, there are more said amounts of upper stream side fruit NOX(s) (Xu) than said amount (Xtu) of upper stream side target NOX(s). and a ****** [that the difference is over a fixed quantity] (for example, Xu>1.05Xtu) -- ** -- when it judges, ECU10 perform increase-in-quantity processing of the amount of EGR in Step 106 - Step 108.

[0074] After [in addition,] processing of said step 106 - Step 108 is performed repeatedly When judged with the EGR increase-in-quantity instruction value having exceeded the amount upper limit of EGR in Step 107, In spite of in other words having increased the amount of EGR to the amount upper limit of EGR, there are more amounts of upper stream side fruit NOX(s) (Xu) than the amount of upper stream side target NOX(s). And when judged with the difference being over a fixed quantity, ECU10 progress to Step 219a and they consider that abnormalities occurred in the EGR mechanism which consists of an EGR valve actuator 9 and EGR valve 5. When it judges with abnormalities having occurred in the EGR mechanism in said step 219a, ECU10 progress to Step 119 and they make a warning lamp turn on.

[0075] When [moreover,] there are not more said amounts of upper stream side fruit NOX(s) (Xu) than said amount (Xtu) of upper stream side target NOX(s) or it judges with the difference not being over a fixed quantity in said step 203 ECU10 progress to Step 204 and they measure the amount (Xtl) of lower stream side target NOX(s), and the amount of lower stream side fruit NOX(s) (Xl). ECU10 have more amounts of lower stream side fruit NOX(s) (Xl) than the amount (Xtl) of lower stream side target NOX(s), and, specifically, they distinguish whether the difference is over a fixed quantity (for example, is it Xl>1.05Xtl or not?).

[0076] When it judges with it being Xl>1.05Xtl in said step 204, ECU10 perform increase-in-quantity processing of the reducing agent amount of supply in Step 109 - Step 111.

[0077] In addition, if it puts in another way when it is judged with the reducing agent amount-of-supply increase-in-quantity instruction value waiting for reducing agent amount-of-supply upper limit in Step 110 in the top after processing of said step 109 - Step 111 was performed repeatedly In spite of having increased the quantity of the amount of supply of a reducing agent to reducing agent amount-of-supply upper limit, there are more amounts of lower stream side fruit NOX(s) (Xl) than the amount (Xtl) of lower stream side target NOX(s). And when judged with the difference being over a fixed quantity, ECU10 progress to Step 219b and they consider that abnormalities occurred in the selection reduction type NOX catalyst 6 or the reducing agent feed unit 7. When it judges with abnormalities having occurred in said step 219b in the selection reduction type NOX catalyst 6 or the reducing agent feed unit 7, ECU10 progress to Step 119 and they make a warning lamp turn on.

[0078] Moreover, when it judges with it not being Xu>1.05Xtu in said step 204, ECU10 progress to Step 205 and they distinguish whether the ratio of the amount of upper stream side

fruit NOX(s) (Xu) and the amount of lower stream side fruit NOX(s) (Xl) is larger than a predetermined value (for example, is it Xl/Xu>1 or not?).

[0079] When it judges with it being Xl/Xu>1 in said step 205, ECU10 progress to Step 219c and they judge with abnormalities having occurred for the upper stream side NOX sensor 18, the lower stream side NOX sensor 8, or the selection reduction type NOX catalyst 6. Then, ECU10 progress to Step 119 and they make a warning lamp turn on.

[0080] Moreover, when it judges with it not being Xl/Xu>1 in said step 205, ECU10 progress to Step 206 and they measure the amount (Xtl) of lower stream side target NOX(s), and the amount of lower stream side fruit NOX(s) (Xl). ECU10 have few amounts of lower stream side fruit NOX(s) (Xl) than the amount (Xtl) of lower stream side target NOX(s), and, specifically, they distinguish whether the difference is over a fixed quantity (for example, is it Xl<0.9Xtl or not?).

[0081] When it judges with it being Xl<0.9Xtl in said step 206, ECU10 perform loss-in-quantity processing of the reducing agent amount of supply in Step 112 - Step 114.

[0082] In addition, if it puts in another way when it is judged with there being few reducing agent amount-of-supply loss-in-quantity instruction values in Step 113 than a reducing agent amount-of-supply lower limit after processing of said step 112 - Step 114 was performed repeatedly In spite of having decreased the quantity of the amount of supply of a reducing agent to the reducing agent amount-of-supply lower limit, when the amount of lower stream side fruit NOX(s) (Xl) is judged as it being few and the difference being over a fixed quantity from the amount (Xtl) of lower stream side target NOX(s), ECU10 progress to Step 207.

[0083] when it judges with it not being Xl<0.9Xtl in said step 206 When it judges with there being few reducing agent amount-of-supply loss-in-quantity instruction values in said step 113 than a reducing agent amount-of-supply lower limit ECU10 progress to Step 207, and there are few amounts of upper stream side fruit NOX(s) (Xu) than the amount (Xtu) of upper stream side target NOX(s), and they distinguish whether the difference is over a fixed quantity (for example, is it Xu<0.9Xtu or not?).

[0084] When it judges with it being Xu<0.9Xtu in said step 207, ECU10 progress to Step 115, and they compute the instruction value (the amount loss-in-quantity instruction value of EGR) over the EGR valve actuator 9 in order to carry out specified quantity loss in quantity of the amount of EGR.

[0085] At Step 209, ECU10 compare the amount loss-in-quantity instruction value of EGR and the amount lower limit of EGR (for example, zero) which were computed at said step 115. Specifically, ECU10 distinguish whether said amount loss-in-quantity instruction value of EGR is less than the amount lower limit of EGR.

[0086] When it judges with there being more said amount loss-in-quantity instruction values of EGR in said step 209 than the amount lower limit of EGR, ECU10 progress to Step 116,

transmit said amount loss-in-quantity instruction value of EGR to the EGR valve actuator 9, and perform loss-in-quantity processing of the amount of EGR. Then, ECU10 repeat and perform processing after Step 207.

[0087] After processing of the above mentioned step 207, Step 115, Step 209, and Step 116 is performed here repeatedly If it puts in another way when judged with the amount loss-in-quantity instruction value of EGR being less than the amount lower limit of EGR in Step 209 In spite of having decreased the quantity of the amount of EGR to the EGR loss-in-quantity lower limit, when the amount of upper stream side fruit NOX(s) (Xu) is judged as it being few and the difference being over a fixed quantity from the amount (Xtu) of upper stream side target NOX (s), ECU10 progress to Step 219e. ECU10 consider that abnormalities occurred in the EGR mechanism, subsequently to Step 119 progress, and make a warning lamp turn on at Step 219e.

[0088] On the other hand when it judges with it not being Xu<0.9Xtu in said step 207 ECU10 progress to Step 208, and there are few amounts of upper stream side fruit NOX(s) (Xu) than the amount of upper stream side target NOX(s), and they distinguish whether the difference is over a fixed quantity (for example, is it Xu<0.1Xtu or not?).

[0089] When it judges with it not being Xu<0.1Xtu in said step 208, ECU10 return to Step 100 and they perform this routine again. On the other hand, when it judges with it being Xu<0.1Xtu in said step 208, ECU10 progress to Step 219d and they consider that abnormalities occurred in the upper stream side NOX sensor 18. And ECU10 progress to Step 119 and they make a warning lamp turn on.

[0090] [here / ECU10 which finished performing processing of Step 119] Like the form of the 1st operation, it progresses to said step 100 promptly, and may be made to perform exhaust air purification control continuously based on the aforementioned exhaust air purification control routine, and after opening the interval of a definite period of time, you may be made to perform said exhaust air purification control. Moreover, it memorizes having progressed to Step 119, while ECU10 made said step 119 the terminal point of the exhaust air purification control routine. You may make it demand prompt restoration of the exhaust emission control device which abnormalities generated from a driver by making a warning lamp turn on at the time of re-starting of the internal-combustion engine 1, and sending warning to a driver again.

[0091] As stated above, the exhaust air purification control means which starts this invention when ECU10 perform an exhaust air purification control routine, and an unusual judging means are realized, and while becoming possible to acquire the same effect as the form of the 1st operation of the above-mentioned, it becomes possible to pinpoint an abrupt increase part at the time of an abrupt increase. Moreover, the warning lamp of this embodiment is equipped with two or more lamps, and you may make it a different lamp for said every unusual judging part turn it on.

[0092]
[Effect of the Invention] Since it becomes possible to use together an exhaust air purification catalyst and a reducing agent supply means, and an exhaust air flowing-back means, and to reduce the burst size of NOX in the exhaust emission control device concerning this invention, While being able to lessen the reducing agent amount of supply compared with the case where the burst size of NOX is reduced, only with an exhaust air purification catalyst and a reducing agent supply means, the amount of exhaust air flowing back can be made less than the case where the burst size of NOX is reduced only with an exhaust air flowing-back means.
[0093] Furthermore, in the exhaust emission control device concerning this invention, since flowing back of exhaust air is preferentially performed as compared with supply of a reducing agent, it becomes possible to decrease the burst size of NOX, stopping the amount of supply of a reducing agent to the minimum.
[0094] Therefore, it becomes possible to reduce the amount of NOX(s) emitted into the atmosphere, preventing the poison of the exhaust air purification catalyst resulting from aggravation of the operational status of the internal-combustion engine resulting from the increase in the amount of exhaust air flowing back, and the increase in the reducing agent amount of supply according to the exhaust emission control device concerning this invention.
[0095] Moreover, since the amount of supply of the fuel as a reducing agent is controlled when using the fuel for an internal-combustion engine as a reducing agent in the exhaust emission control device concerning this invention, aggravation of fuel consumption is prevented.

[Translation done.]